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(Reaffirmed 2001)

Indian Standard

**GLOSSARY OF TERMS
RELATING TO RIVER VALLEY PROJECTS**

PART XX TUNNELS

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG

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GLOSSARY OF TERMS
RELATING TO RIVER VALLEY PROJECTS

PART XX TUNNELS

Terminology Relating to River Valley Projects
Sectional Committee, BDC 46

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DR H. R. SHARMA	Central Water Commission, New Delhi

Indian Standard

GLOSSARY OF TERMS
RELATING TO RIVER VALLEY PROJECTS

PART XX TUNNELS

0. FOREWORD

0.1 This Indian Standard (Part XX) was adopted by the Indian Standards Institution on 21 February 1983, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A number of Indian Standards have already been published covering various aspects of river valley projects and a large number of similar standards are in the process of formulation. These standards include technical terms, the precise definitions of which are required to avoid ambiguity in their interpretation. To achieve this end, the Committee is bringing out this standard. The other parts of the standard are listed on page 11.

1. SCOPE

1.1 This standard covers the definitions of terms relating to tunnels. However, this standard does not cover terms relating to tunnel equipments and geology.

2. DEFINITIONS

2.1 Access Tunnel — An approach tunnel provided to reach any underground passage, cavern or structure.

2.2 Adit — A horizontal or nearly horizontal access tunnel provided to reach inside of a main tunnel. It may also apply to a passage within concrete structures, such as dams or spillways.

2.3 Arch Action — The action of transference of load of rock including its overburden across a tunnel or structure on to the two sides of the tunnel or the abutments.

2.4 Back Packing — Filling of gap between lagging and rock.

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2.5 Benching — The operation of removal of the lower portion of the tunnel profile after the top heading has been excavated.

2.6 Blocking — A process of providing wedges between rock and the ribs to transfer the rock load to the ribs.

2.7 Bottom Heading — The face of the tunnel where actual tunnelling operations are in progress. However, when it is prefixed by 'top' or 'bottom' it denotes a part section excavated in advance in the line of the intended tunnel.

2.8 Bracing — A stiffening member provided between ribs/posts to prevent their buckling or shifting.

2.9 Brattice — A partition wall of cloth plastered with clay erected especially in a mine tunnel to divide the excavation in two parts lengthwise. The division permits the fresh air to pass-in through one part and the stale air to passout through the other, thus, improving the ventilation of the work area.

2.10 Breast Boards — A temporary support to prevent the face from caving in or flowing into a tunnel.

2.11 Bridge Action Period — It is the time which elapses between firing the shots and the breakdown of the equilibrium of the half dome of unsupported section beyond the last rib of the tunnel supports.

2.12 Bulkhead — A barrier placed at a tunnel heading to prevent inflow of water or shattered rock into the tunnel.

2.13 Cable Tunnel — A tunnel for leading power cables from power house to switch yard.

2.14 Cavitation — The phenomenon and the consequential formation of cavitation or pittings caused by the collapse of vapour bubbles in zones undergoing change from excessively low (or negative) to high pressure on the surface of a structure over which the liquid flows.

2.15 Conventional or Drill and Shoot Tunnelling — Method of excavating tunnel involving drilling of holes in the tunnel face, loading with explosive and then blasting.

2.16 Cover — Cover on a tunnel in any direction is the distance from the tunnel soffit to the exposed surface of ground/rock in that direction.

2.17 Crown Bars — These are horizontal bars provided during excavation at the crown of the tunnel for supporting the roof and are located parallel to the centre line to ensure safety and limit overbreak.

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2.18 Cut — In the drilling pattern (*see* 2.24) the group of holes fired first in a round to provide additional free faces for the succeeding shots.

2.19 Cut and Cover Section — A closed section of a water-way that is formed by first excavating an open channel in the ground and then roofing it over.

2.20 Detonator — A device for producing detonation in a high explosive charge, and initiated by a safety fuse or by electricity.

2.21 Dome Action — The action of transference of load of rock including its overburden across the tunnel on its sides, or in a tunnel near the heading on sides and working face.

2.22 Drift — A horizontal tunnel usually of small cross-section and length driven either from surface for exploration purposes or from an underground face for any purpose.

2.23 Drill Carriages — A vehicle on which one or more drill booms are mounted to permit the drills to be brought easily to their work site and to be removed before blasting.

2.24 Drilling Pattern — An arrangement showing location, direction and depth of the holes to be drilled into the face of a tunnel.

2.25 Dry Intake Tower — An intake tower through which passes pipe carrying water under pressure. The interior of the tower is dry and is accessible for inspection and operation of the intake pipe.

2.26 Easer — Ring of holes drilled around cut holes and fired after cut holes.

2.27 Explosive — Any mixture of chemical compound which, under favourable conditions, will burn or detonate quickly to produce high pressure.

2.28 Final Lining — It is the concrete between primary lining and the finished face of the tunnel.

2.29 Fore Poling Method — Method of tunnelling by driving wood or steel members into soft or weak rock/ soil in the arch of the tunnel beyond the heading to provide roof support.

2.30 Free Level Tunnel or Free Flow Tunnel — A tunnel in which water flows with a free water surface.

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2.31 Full Face Method — Excavating tunnel in full section with a single operation.

2.32 Grade Tunnel — A waterway tunnel constructed with the elevation of the top above the hydraulic gradient.

2.33 Guniting — A process of applying mixture of sand and cement pneumatically conveyed in a dry state to the nozzle of the gun where water is added immediately prior to expulsion and shot into place. Wet mixing can also be adopted as an alternative.

2.34 Heading — The face of the tunnel where actual tunnelling operations are in progress. However when it is prefixed by 'top' or 'bottom' it denotes a part section excavated in advance in the line of the intended tunnel.

2.35 Head Race Tunnel — A tunnel leading water from a reservoir or headworks to the forebay/penstock intakes/turbines.

2.36 High Explosive — An explosive that reacts to detonation as an extremely rapid, almost instantaneous process with consequential release of tremendous energy and produces large volume of gases at exceptionally high pressure.

2.37 Inlet or Intake Structure — A structure built at the upstream end of an water conductor system to draw water usually combined with trash rack structure.

2.38 Intake or Inlet Control Structure — It is the inlet or intake structure housing the regulating and/or emergency gates.

2.39 Intake Ports — The openings in the intake structure or tower which admit water.

2.40 Intake Tower — An inlet control structure to enable controlled drawal of water from lakes, reservoirs or rivers with wide fluctuations or at different depths or both.

2.41 Invert — The floor, bottom or lowest portion of the internal cross section of a tunnel.

2.42 Invert Strut — Strut installed between the side posts at the invert of the tunnel to withstand side pressure.

2.43 Jumbo — A mobile platform with number of decks used at the heading of large size tunnels for drilling and also for scaling, erection of roof supports, guniting, shotcreting, etc.

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2.44 Jump Set — Steel or timber set placed between existing sets to provide additional support.

2.45 Lagging — Members of a tunnel support which span the space between main supporting ribs.

2.46 Machine Tunnelling — Method of excavating tunnel by deploying machines such as mole, shield, drifter, etc, without using explosive. Also known as 'Boring a Tunnel'.

2.47 Minimum Excavation Line (A Line) — It is the line within which no unexcavated material of any kind shall be permitted to remain.

2.48 Mucking — The operation of removal of the blasted stones/material after the blast has taken place.

2.49 Outlet Tunnel — A tunnel for controlled releases of water for irrigation, water supply and/or power generation from the storage reservoir.

2.50 Outlet Works — A collective term for all components of the means provided in a hydraulic system for release or drawal of water. The term includes such items as trash barrier, intake structures, the tunnels or conduits the emergency and regulating gates or valves, the gate chamber or valve houses and stilling basin. This term excludes spillways.

2.51 Overbreak — Removal of rock as the result of a blast, beyond the minimum excavation line.

2.52 Overflow Shafts — Shafts in long pressure tunnels constructed to limit internal pressures by over-flow beyond a certain hydro-static head and to serve as air-vents for inlets during filling and emptying.

2.53 Overt — The top arch portion of the tunnel.

2.54 Packing — Material which is used to fill the empty space between the lagging and rock surface.

2.55 Pay Line (B Line) — An assumed line (beyond A-line) to which payment of excavation is made whether the actual excavation falls inside or outside it. Sometimes B-line may merge with A-line.

2.56 Permanent Supports — These are tunnel supports which are left in place permanently.

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2.57 Pilot Tunnel — A tunnel smaller in section driven ahead of a main tunnel to determine its strata, grade and direction, and/or to facilitate the construction of main tunnel by enlargement method.

2.58 Popping — Falling of thin slabs of rock suddenly detached after the rock has been exposed in a tunnel.

2.59 Portal — *See 2.94.*

2.60 Power Tunnel — A tunnel for supplying water under pressure or free flow to the penstocks or turbines.

2.61 Pre-Splitting — Creating artificial crack along periphery of tunnel by drilling hole at suitable spacing, leading alternative holes and blasting.

2.62 Pressure Shaft — A vertical or inclined shaft designed to take up high pressures.

2.63 Pressure Tunnel — A tunnel in which the water is under pressure and wets its entire perimeter.

2.64 Primary Lining — A concrete lining laid immediately after excavation and installation of steel supports. This may cover the full section excavated or part section depending on conditions of strata.

2.65 Primer Cartridge — The explosive cartridge into which the detonator has been inserted.

2.66 Rib: Rib and Post or Rib, Post and Invert Strut — These are the components of support system.

2.67 Rock Bolts — Long steel bolts inserted into rock and concrete by wedging, by expanding sleeves or cementing to support laminated, partially detached or otherwise incompetent strata.

2.68 Rock Burst — A sudden explosive detachment of a rock slab or rock mass from the arch, wall or invert of any underground opening.

2.69 Rockcrete — A nearly dry mixture of sand, crushed rock, and cement sprayed on the arch and wall of a tunnel to provide support.

2.70 Rock-Load — It indicates the height of the mass of rock which tends to exert pressure on the support.

2.71 Scaling — An operation to remove all loose bits of rock from the blasted surface, after the blasting is over.

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- 2.72 Shaft** — A nearly vertical pit or well driven from surface to tunnel or gallery or any other underground opening.
- 2.73 Shotcrete** — Pnuematically applied mixture of cement, sand, water and small coarse aggregate (up to 10 mm) shot into place.
- 2.74 Side Drift** — Drift on the side of the tunnel.
- 2.75 Skeleton Lagging** — Lagging placed with interstices.
- 2.76 Soffits** — Under surface of the top of an arch.
- 2.77 Soft Strata** — Strata having tensile and shearing strength far below than that of hard, firm rocks. The stand-up time of such strata is limited and consequently an opening excavated through them requires supports to be installed within a short period of excavation.
- 2.78 Soils** — *See* IS : 1498-1970*.
- 2.79 Spitting Rock** — A rock mass under stress that breaks and ejects small fragments with considerable velocity.
- 2.80 Spreader** — Wood section placed between ribs to maintain tension on tie rods or preserve alignment.
- 2.81 Squeezing Rocks** — Rock strata which due to inherent internal stresses, gradually squeezes into the excavated profile.
- 2.82 Stemming** — The adding of inert material, such as rock dust, in a borehole on top of an explosive to confine the energy of the explosion.
- 2.83 Stopping** — Operations for over head excavation by drilling from an underground face.
- 2.84 Submerged Intake** — An intake structure functioning entirely under water.
- 2.85 Swelling Ground** — Rock that swells after being exposed. Usually increases in volume because of hydration of clay minerals in an altered rock.
- 2.86 Tail Race Tunnel** — A tunnel conducting water released from water turbines to a suitable point for further disposal.
- 2.87 Temporary Supports** — These are tunnel supports which are erected during excavation and removed before erection of either the permanent lining or permanent supports.

*Classification and identification of soil for general engineering purposes (*first revision*).

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2.88 Tight Lagging — Lagging without interstices.

2.89 Top Heading — *See 2.34.*

2.90 Transition — A length of tunnel wherein the cross-sectional shape is gradually changed from that of the tunnel upstream to that of the tunnel downstream.

2.91 Trimmer — Holes at the periphery of an excavation, fired to give the excavation its final outline.

2.92 Truss Panel — Panel located on the spring line constituting a temporary support for ribs while taking out the bench and are replaced by posts in the final stage of erection. These serve a function similar to that of crown bars.

2.93 Tunnel — A passage constructed underground through high ground or mountains, open at both ends so as to provide a path for a road, railway, water, sewage, etc.

2.94 Tunnel Portal — Structure built at the inlet (or entrance) and outlet (or exit) of the tunnel.

2.95 Tunnel Portal Transitions — Structural arrangements at inlet and outlet portals of the tunnel changing the shape of the flow area, to obtain desirable flow conditions.

2.96 Tunnel Spillway — A tunnel used as a spillway.

2.97 Tunnel Spillway Bucket — A device to deflect and spread the high velocity flow high into the air and permit the dissipation of energy at a safe distance downstream from the tunnel outlet.

2.98 Tunnel Support — Structure erected in the tunnel to support the strata surrounding the excavated section.

2.99 Valve Chamber or Valve House — A structure housing the regulating valves, control mechanism for operation of valves and equipment required to remove parts for repair, etc.

2.100 Wall Plates — Sills for ribs for transmitting the load from ribs through blocks or posts to the rock.

2.101 Wall Plate Drift — Drift at the spring line to install wall plates.

2.102 Weeper (Weep) — A pipe or drilled hole in rock or concrete designed to relieve pressure of underground water on the tunnel lining.

2.103 Wet Intake Tower — An intake tower which is filled with water to the level of the source of supply.

**INDIAN STANDARDS
ON
TERMINOLOGY RELATING TO RIVER VALLEY PROJECTS**

IS :

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31

Telegrams : Manaksanstha

Regional Offices:

Telephone

Western : Novelty Chambers, Grant Road

BOMBAY 400007

89 65 28

Eastern : 5 Chowringhee Approach

CALCUTTA 700072

27 50 90

Southern : C. I. T. Campus

MADRAS 600113

41 24 42

Northern : B69, Phase VII

S.A.S. NAGAR

8 78 26

(MOHALI) 160051

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur

AHMADABAD 380001

2 03 91

'F' Block, Unity Bldg, Narasimhara Square

BANGALORE 560002

22 48 05

Gangotri Complex, Bhadbhada Road, T. T. Nagar

BHOPAL 462003

6 27 16

22E Kalpana Area

BHUBANESHWAR 751014

5 36 27

5-8-56C L. N. Gupta Marg

HYDERABAD 500001

22 10 83

R 14 Yudhister Marg, C Scheme

JAIPUR 302005

6 98 32

117/418 B Sarvodaya Nagar

KANPUR 208005

4 72 92

Palliputra Industrial Estate

PATNA 800013

6 28 08

Hantex Bldg (2nd Floor), P'y Station Road

TRIVANDRUM 695001

32 27